

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Friedrich BOECKING  
Based on : PCT/DE 03/1799  
Title : Piezoelectric Actuator  
  
Docket No. : R.302457  
Customer No. : 02119

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97(b),  
AND EXPLANATION OF THE RELEVANCE OF THE CITED PRIOR ART**

Sir:

The undersigned hereby requests that the prior art cited on the attached prior art statement be placed of record in the application file and be considered by the examiner.

This citation of prior art is made under 37 CFR 1.97(b), since it is being filed within three months of the filing date and before the mailing of a first Office action.

The relevance of the prior art cited on the attached form 1449 is as follows:

Appl. No. Unknown  
IDS Under 37 CFR 1.97(b)  
Prior to first Office Action

**US 5,252,883**

This patent teaches a laminated type piezoelectric actuator having a laminated body formed by alternately laminating piezoelectric ceramic layers and internal electrode layers, each of which are approximately the same shape. The four corners or edges of each layer of the ceramic layers and the internal electrode layers, which edges extend in parallel with the lamination direction of the laminated body, are machined to form a convex, arcuate shape or an angled, planar shape. This enables the end parts of each layer, which have a high distribution density of microcracks, to be removed, so that interlayer short-circuiting between the internal electrode films caused by the microcracks is prevented. Accordingly, the operation life and the reliability of the actuator of this invention is extended and improved, respectively, even when it is driven by a driving voltage which is exactly or close to that of a dc voltage in a highly humid environment. By using a Pb (Ni<sub>1/3</sub>Nb<sub>2/3</sub>) O<sub>3</sub>-PbTiO<sub>3</sub>-PbZrO<sub>3</sub> system perovskite structure compound oxide as the piezoelectric ceramic piece, and removing each of the four edges in the cross section to exhibit a convex, arcuate shape (the shape having a radius of curvature equal to or greater than 1.0 mm) or an angled, planar shape (having a chamfering length equal to or greater than 0.8 mm) it is possible to increase the life of the actuator to about 10 times that of the actuator of the prior art.

**DE 199 46 837 A1**

This patent teaches a piezoelectric actuator, for example for actuating a mechanical component. The piezoelectric actuator is composed of a multi-layer structure of piezoelectric layers (2) and interposed inner electrodes (3, 4; 11, 12; 21, 22) that are buried in said

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piezoelectric layers (2) in such a manner that in a defined zone they do not extend to the exterior of the piezoelectric actuator (1; 10; 18). The inner electrodes (3, 4; 11, 12; 21, 22) are connected to the outer electrodes in a manner alternating from layer to layer. The connection is made in the zone in which, in the adjoining layer, no inner electrode (3, 4; 11, 12; 21, 22) extends to the exterior of the piezoelectric actuator.

**EP 0 584 842 A2**

This patent teaches a laminated ceramic device that can prevent concentration of stress due to unevenly distributed strain caused by the application of an electric field. According to the invention, the laminated ceramic device comprises a plurality of ceramic sheets that can be subjected to electro-strictive force. First and second groups of filmy internal electrodes are provided, the electrodes of the first and second groups being alternately arranged and interposed one by one between two adjacent ceramic sheets. A first external electrode is connected to an edge of each of the internal electrodes of said first group and a second external electrode is connected to an edge of each of the internal electrodes of the second group. Spaces are provided between the first external electrode and each of the internal electrodes of the second group and between the second external electrode and each of the internal electrodes of said first group. According to the invention, a method of manufacturing the device is also provided.

**JP 2001-339101**

This patent teaches a gallium nitride compound semiconductor light emitting element whose luminous intensity and light takeout efficiency are improved and whose low operating

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voltage can be realized. The gallium nitride compound semiconductor light emitting element contains at least an  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  active layer 104 (where,  $0 \leq x < 1$ ;  $0 < y \leq 1$ ;  $0 < x+y \leq 1$ ), p-type semiconductor layers (105, 106) and a metal Pd thin-film electrode layer (107) which are laminated sequentially on a substrate (101). The interval between the active layer (104) and the electrode layer (107) is set at 10 to 40 nm.

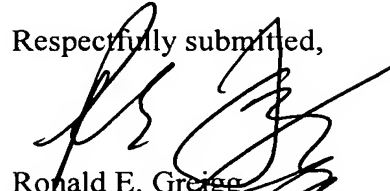
**DE 196 26 671 C1**

This patent teaches a high frequency piezoelectric power actuator apparatus with heat dissipation. A stack of elementary polarized rings (1) of sintered lead zirconate-titanate ceramic with contact material (3) between them is provided. The rings are bonded by thermally hardened epoxy resin to plates (2) of copper-bronze alloy 100  $\mu\text{m}$  thick with smaller central holes. Alternate plates are interconnected by copper wires (7) with dip-soldered joints (6). The portion of each plate protruding from the stack is in the form of a 270 degree segment of a circle with the same external diameter ( $D_2$ ), extending tangentially into a rounded 90 degree vertex. With an applied voltage of 1 kV such a device has an expansion of 21  $\mu\text{m}$  and capacitance of 111 nF.

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Examination of this application is respectfully requested.

Respectfully submitted,



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**INFORMATION DISCLOSURE CITATION**  
(Use several sheets if necessary)

Docket Number (Optional)

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Application Number

10/524789

Applicant(s)

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DE12 Rec'd PCT/PTO 16 FEB 2005

Filing Date

Group Art Unit

**U.S. PATENT DOCUMENTS**

*EXAMINER INITIAL	REF	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		5,252,883	10-12-1993	Masahiro KONDO			

**U.S. PATENT APPLICATION PUBLICATIONS**

*EXAMINER INITIAL	REF	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

**FOREIGN PATENT DOCUMENTS**

	REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	Translation	
							YES	NO
		DE 199 46 837 A1	05-03-2001	Germany				✓
		EP 0 584 842 A2	03-02-1994	European			✓	
		JP 2001-339101	12-07-2001	Japan				✓
		DE 196 26 671 C1	10-16-1997	Germany				✓

**OTHER DOCUMENTS**

(Including Author, Title, Date, Pertinent Pages, Etc.)


EXAMINER

DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP Section 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.